The Newsletter of the Earth Sciences Directorate

Earth Sciences NEWS

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A Message From the Director of Earth Sciences: Celebrating the Varied Roles of Directorate Staff

— Dr. Vincent Salomonson

I am happy to introduce the second issue of *Earth Sciences News*, largely devoted to the work of the Earth Sciences Directorate (Code 900) staff. This issue contains more detail on particular aspects of Code 900, including the new storage capabilities available in the Earth and Space Science Data Computing Division (Code 930) the breakthrough work in UV-B radiation measurements by Dr. Jay Herman and his group in the Atmospheric Chemistry and Dynamics Branch (Code 916). In addition, there are several articles containing education and outreach initiatives undertaken by some of the Code 900 staff.

The underlying theme in this issue is our education and outreach efforts. Many of these articles focus on what the subjects gave back to the community, from the large-scale outreach programs of GISS led by Jim Hansen, to the more intimate efforts of Joanne Simpson, responding to a letter. I feel strongly that education and outreach activities should fit within our duties —not to the exclusion of all else, but rather to augment our work. The scientific research done by the outstanding scientists throughout the directorate can be shared through outreach and education efforts—the UV–B work, for example, will provide a direct public health benefit. Also, the increased capabilities of our computing machines also enable us to serve the public. The storage facility in Code 930, while offering scientists state–of–the–art storage and retrieval capability with unprecedented speed and ease, also enables our users to create images capable of being used to explain difficult scientific concepts to the public. Much of the research done in the directorate, such as that done with the satellite images of "city lights", filters its way into the public, either as press releases or as information in a textbook taught to the next generation of scientists.

It is important to continue to look for ways to deliver the importance of Earth science work to an audience other than scientific peers (Ref: NASA Strategic Plan and the Goddard Strategic Plan). For all of you who are already contributing your time and effort to education and outreach, I thank you. By simply contributing an image to the Education Office here at Goddard for publication as a lithograph, by producing CD-ROMs or lesson plans to be put in Teacher Resource Laboratories and Centers throughout NASA, by volunteering your time to the Speaker,s Bureau here on Center, by acting as a mentor in the Maryland Ambassador Program, etc, each effort is appreciated. On another note, I wish emphasize what most, if not all of you already know; namely, there are a lot of changes occurring or underway at the Center. I urge everyone in or associated with the Directorate to be familiar with the NASA Strategic Plan and to follow closely the development of the Goddard Strategic Plan. In addition there are copies available now of the "Mission to Planet Earth (Code Y) Strategic Enterprise Plan, 1996-2002" and the "Mission to Planet Earth Science Research Plan". About a hundred of the last two documents have been distributed throughout the Directorate The web locations for some of these documents are: (NASA plan) http://www.hq.nasa.gov/office/nsp/environ.html; (MPTE Strate-

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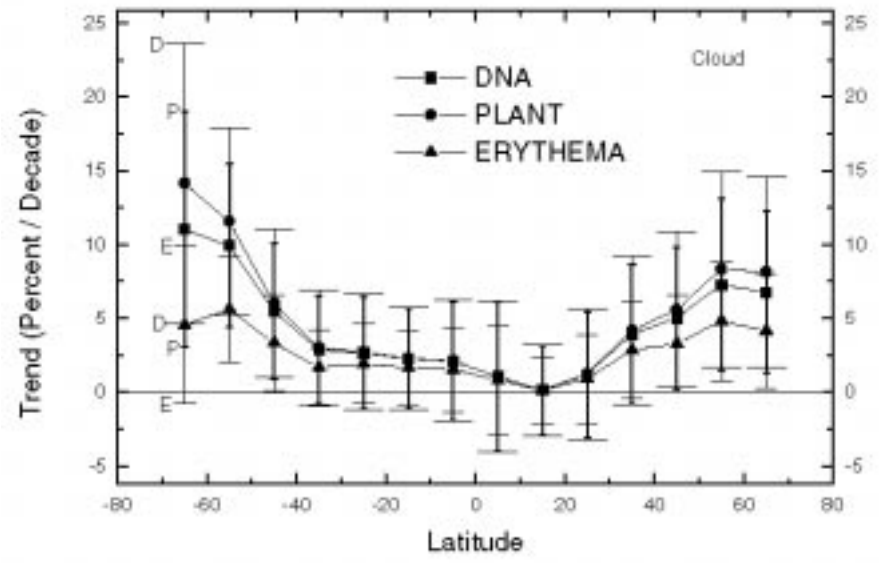
New Ways of Determining UV Radiation Exposure

If you suspect you might be burning at the beach a little more easily now than you have in the past, you may be right. The reason may be due to a measurable increase in the amount of harmful ultraviolet radiation reaching the surface of the Earth, according to Dr. Jay Herman in the Atmospheric Chemistry and Dynamics Branch. Dr. Herman and his team, Drs. P.K. Bhartia, Jerry Ziemke, Zia Ahmad, and Mr. Dave Larko, studied 15 years worth of data from the Total Ozone Mapping Spectrometer on-board the Nimbus–7 satellite showing fluctuations in the amount of UV–B radiation scattered back through the atmosphere and inferred the amount reaching the ground at latitudes between the Equator and 65 degrees north and south. They validated these satellite measurements with those from a Brewer instrument at a ground station based in Toronto, Canada, which measured both UV-B and UV-A radiation (UV–A, the longer wavelength type of ultraviolet radiation, is not very sensitive to ozone levels).

What is significant in these findings is that Dr. Herman's group has found a way to account for the effects of clouds and pollution as well as ozone changes. This makes the relationship clearer between changes in the protective ozone layer and changes in the amount of UV–B getting to the surface. Dr. Herman's team found that there seems to be a 2 percent increase in the UV–B that can cause DNA damage for every 1 percent decrease in the ozone layer. According to this study, published in the August 1 issue of *Geophysical Research Letters*, the average increase in the amount of UV–B reaching the Earth is 4 percent per decade at Washington, DC's, latitude (40 degrees north). At higher north latitudes (around England and the Scandinavian countries) the increase is about 6.8 percent per decade. In the higher southern latitudes, however (the southern portion of Argentina and Chile), the increase is about 9.9 percent per decade. These results were also reported by Staff Writer Kathy Sawyer in a Washington *Post* article appearing on August 2.



DNA, plant, and erythema action-spectra weighted UV-flux exposure integral for the period 1979 to 1992 including the effects of clouds.

These large increases have implications for plant, animal, and human life all over the planet. Radiation has long been known to affect the way plants grow, as well as to affect the DNA in living organisms. The chart above shows the results of Dr. Herman's studies measuring those effects. It is clear that the higher the latitude, the more pronounced the percentage increase. Doctors and scientists have been warning the populations in the extreme southern latitudes for years about the harmful effects of the loss of the ozone layer, leading to, in some cases, nationally sponsored efforts to protect the public. New Zealand and Chile in particular feel the effects of increased radiation exposure and have launched public awareness campaigns to encourage the populations to wear protective clothing and sunblocks during the worst parts of each day, or better yet, not to go outside unless necessary. What this study indicates is that some of the most populated areas in the Northern Hemisphere ought to be more careful as well.

The findings from this long-term data set will set to rest some of the controversy surrounding measurements of UV radiation reaching the surface. In the past, clouds and other atmospheric effects have not been completely taken into account, leading to uncertainties in the quantification of the results. In the *Post* article, Dr. Jack Kaye of NASA is quoted as say-

ing, "[The new technique] accounts for ozone, accounts for UV–B, accounts for clouds. The real advance is that we will now get data about all those things at the same time, together." The article also notes that while the results of this study are significant, there is no cause for alarm. The amount of UV reaching the Earth's surface during a year at a given location can vary routinely by as much as 20 percent year to year. In addition, there is a normal difference in the amount of UV reaching the Earth at different latitudes that is a larger effect than that produced by current decreases in the ozone layer. Because of larger sun angles, low and middle latitudes will normally have more UV reaching the ground; higher latitudes will have less.

Another key finding, quoted in the article, is that there has been no global change in cloudiness or haze over the term of the data set, implying that the UV changes are not caused by changes in the amount of clouds and haze. Locally induced "pollution shields" around some cities, however, do have some moderating influence on the amount of UV radiation.

What does all of this mean? Since 1987, the international community has banned the use of some chemicals thought to harm the ozone layer. Over the next 10–15 years, we will be seeing a slowing down in the rate of destruction of the ozone layer, and soon afterward a gradual restoration to where it would be before fluorocarbons were introduced for air–conditioning and industrial processes. This new technique applied to the current Earth Probe/TOMS and ADEOS/TOMS will allow much more accurate analysis of the relationship between increased ozone and radiation reaching the Earth.

— Kathy Pedelty

Nighttime City Lights Help Estimate Impact of Urban Land Use on Soil Resources

Nighttime "city light" footprints derived from the Defense Meteorological Satellite Program/Optical Line Scanner (DPMS/OLS) satellite images were merged with census data and a digital soils map in a continental–scale test of a remote sensing and geographic information system methodology. The goal of this effort by a team of scientists led by Dr. Marc Imhoff (Code 923) was to approximate the extent of built-up land and its potential impact on soil resources in the United States. Using image processing techniques and census data, Imhoff and colleagues generated maps where the "city lights" class represented mean population densities of 947 persons per square kilometer and 392 housing units per square kilometer, areas clearly not available to mechanized agriculture. In the analysis, such "city lights" representing urban areas accounted for 2.7% of the surface area in the US, an area approximately equal to the State of Minnesota or one half the size of California. Using the UN/FAO Fertility Capability Classification System to rank soils, results for the US showed that development appears to be following soil resources, with the better agricultural soils being the most urbanized. Some unique soil types appear to be on the verge of being entirely co-opted by "urban sprawl." Urban area figures derived from the DMSP/OLS imagery compare well to those derived from statistical sources. Further testing and refinement of the methodology remain but the technique shows promise for possible extension to global evaluations of urbanization and even global productivity.

Goddard Scientist Highlights a Century of Progress

The November issue of the *Journal of Geoscience Education*, the country's leading geological education journal, featured a summary of what Dr. Paul Lowman (Code 921) considers to be the 12 most important discoveries in geology and solid Earth geophysics of the 20th century (which are all discrete and reasonably mature). The most notable and fundamental work addressed is the discovery of the radioactive decay law by Rutherford and Soddy in 1904, which has had pervasive impact on almost all areas of geology and geophysics. Other important discoveries include discovery of the Earth's internal structure: core, mantle, and crust by seismology—a major discrete discovery; X-ray diffraction, the elastic rebound mechanism for earthquake generation; the cause of overthrust faulting; geodetic proof of seafloor spreading; the pattern of planetary differentiation; and the importance of impact cratering on the Earth. It is interesting to note that the last three discoveries are the result of the space program.

Dr. Joanne Simpson — Her Remarkable Journey

Dr. Joanne Simpson and her Grandchild

Joanne Simpson had already established herself as an independent-minded person by the age of 14, when she decided that, "No matter what happened, I was going to put myself in the position to make my own living, and to provide for whatever children I might have without having to depend on anybody else." This approach virtually guided the rest of her life, as she faced—and successfully dealt with—women's issues at a time when women were almost uniformly treated as second-class citizens, much more so than is found today.

Dr. Simpson chose to attend the University of Chicago for undergraduate work, as a form of rebellion against the "'Eastern Seaboard Syndrome' where young ladies of prep schools went to one of the Seven Sisters girls' colleges" like Radcliffe, she says. Her career at Chicago started out with a focus on political and social sciences, but took a radical change in direction with her involvement in a flying club and her lifelong penchant for sailing. Both these activities involve close attention to weather, and so rather than leave college to enlist in the military as she wanted, she found herself involved in the World War II meteorology training programs for aviation cadets. It was at this time that she began to find obstacles to women in professional fields.

As her fascination with meteorology continued to grow, so did her frustration with the problems associated with being a woman on this virtually all-male playing field. Fortuitous exposure to several open-minded, male, world-class scientists combined with her indomitable will and fierce self-confidence allowed her access to several opportunities that resulted in a continuous rise in the groves of academe and research. These culminated in her seeking and finding a position at Goddard in 1979 on a 1-year leave from a faculty position at the University of Virginia; that 1-year leave became 2. And then there came a possibility for a third year here. At that point, the University of Virginia said, basically, "Come back, or lose your position." Finding things much more to her liking at Goddard, where she found kindred spirits and many more opportunities than were available at Virginia, Dr. Simpson chose to stay, and has been at Goddard ever since, staying longer than she had in any other position.

"Moving every 7–10 years to a new environment is very stimulating and very important," she says about the way young (in their 40's) scientists move about these days. She fits this model, too, as she had spent 5–7 years at each of several universities, and spent 10 years at NOAA. She has spent the past 11 years as project scientist on the Tropical Rainfall Measuring Mission (TRMM) but, she says, "…that's long enough." When TRMM, which is currently undergoing thermal vacuum and other prelaunch testing, lifts off in 1997, she will turn over her duties to Dr. Chris Kummerow and pay more attention to her other activities, which include her duties as an officer in the American Meteorological Society, getting back to research, writing review articles, and dealing with young people.

Working with young people is important to her. While she says she's pretty burned out on teaching large classes, she still finds great enjoyment and rewards in working with students on a research basis. In addition, as a world-class scientist Dr. Simpson is often called upon as a role model for young people, especially women. This is a role that she's been happy to play for many years, but, she says, "I have carried the burden of being a role model for women for so many years that I decided 5 or 10 years ago that since there are now so many brilliant young women who have won awards who are in their 40's and 50's, that I have simply retired from being a role model. It's somebody else's turn now."

That doesn't stop her from being responsive, however. In the midst of her myriad activities, Dr. Simpson still finds time to respond to a request by a sixth-grade girl who, "...wanted to know how I got into meteorology, and what careers were available, and so on. Tricia [Gregory; Dr. Simpson's administrative assistant] and I have sent her a lot of information, and I wrote her an E-mail answering as

many of her questions as I had time for. I mean, there are people coming all the time, wanting information, and wanting to talk to me, or find out about the work. If I said yes to every one of them I would do nothing else whatsoever."

In 1994, Dr. Simpson was awarded the first William Nordberg Memorial Award for Earth Science. The Nordberg Award is given annually to an employee of the Goddard Space Flight Center who best exhibits broad scientific perspective, enthusiastic programmatic and technical leadership on the national and international levels, wide recognition by peers, and substantial research accomplishments in understanding Earth system processes that exemplified Dr. Nordberg's own career.

To hear Pat Greco, of the Employee and Organizational Development Office (Code 114), tell it, when candidates for the Nordberg Award were being reviewed, the choice of the recipient was, "...a no-brainer." Dr. Simpson was the obvious choice.

The program from the 1994 award ceremony stated that, "The...award [was] presented to Dr. Joanne Simpson for her scientific pioneering efforts, characterized by a remarkable series of original scientific contributions and a record of public service which has done much to advance the field of meteorology. Dr. Simpson's work has encompassed a wide range of observational theoretical and modeling studies. Her pioneering observational studies on trade wind clouds and the 'hot tower' hypothesis helped to establish our basic understanding of the maintenance of the tropical circulation and heat balance. She pioneered the field of cloud modeling with the development of a 1–dimensional cloud model, and has continued work in this area throughout her career as principal investigator on various cumulus cloud modeling projects. She has had extensive experience in planning and leading observational experiments on convective cloud systems. Dr. Simpson has long recognized the value of satellite observations for advancing our understanding of the tropics. As Project Scientist for the Tropical Rainfall Measuring Mission (TRMM), she has led the effort on all aspects of the mission from its inception. Finally, Dr. Simpson has been a role model for women in science and engineering by being elected to the National Academy of Engineering and serving as President of the American Meteorological Society."

Clearly, Dr. Simpson is a heavy hitter in her profession. But there's much in her personal life in addition to her profession that has been instrumental in bringing her to where she is today.

Even with all the time she spends on professional activities, this 73-year-old mother and stepmother of five tries to balance her personal and professional lives. Indeed, when asked to describe the high point in her life, she lists three: When she married Bob Simpson, when her daughter was born, and when she won the Rossby Award. Reflecting upon her response, she notes that two of the three are personal matters. Dr. Simpson says that she feels she was a good mother, despite her need to work harder because she is a woman. With time, her children and their spouses have all turned out just fine, and she's proud of all of them. But she also says that she's a much better grandmother to five grandchildren than she was a mother. As she put it, "It's so much more fun and much easier to be a grandma!"

While she pays a lot of attention to her family, Dr. Simpson's main focus is still professional activities. When asked for a few closing comments, she chose to focus on this advice to young researchers: "The atmosphere and the oceans are very exciting both in terms of sailing on them and what they do in the way of disasters, and learning about how they move and behave, and although jobs are tight now, young people can still get PhD's and get jobs. Maybe the job market will recover. So, I would encourage a young person who is interested in science—and particularly in weather and ocean science—to go right ahead and get into it, but that they have to look for a field or a subfield where there are jobs. It ain't easy nowadays."

With that, Dr. Simpson returned to her desk to answer telephone calls about TRMM and about her American Meteorological Society duties—and to finish her E-mail response to that sixth-grader who was looking for information.

— Dr. Mitchell K. Hobish

National Academy of Science Member Dr. Jim Hansen Makes Science Accessible

Dr. Jim Hansen

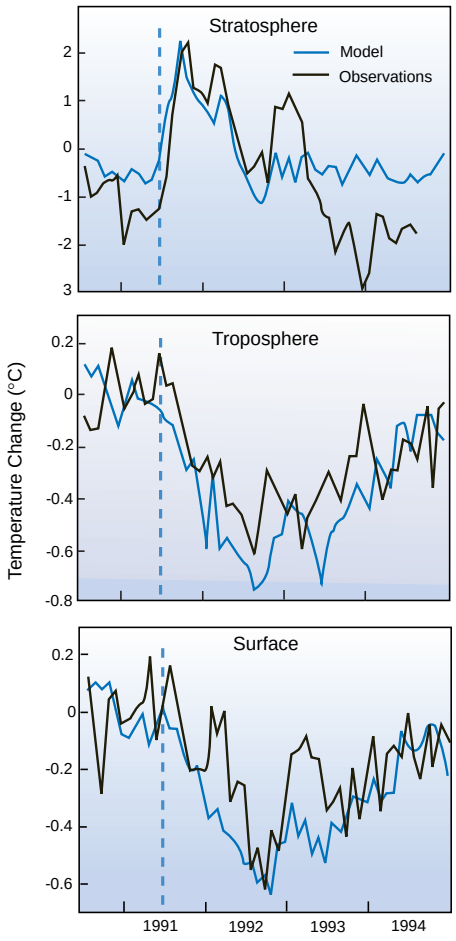
What else can be said about Jim Hansen that hasn't already been said? His life story is well known at Columbia University, where he was Adjunct Associate Professor of Geological Sciences from 1978 to 1985 until his promotion to Adjunct Professor of Geological Sciences. His professional history appears in Current Biography where, in alphabetical order, he comes before cartoonist Chuck Jones. Hansen's reaction to this? He couldn't remember who Chuck Jones was, but that's another story.

In reading through the background material, so many articles have been written about the man who went before the Senate Energy and Natural Resources Committee and declared that the Earth's climate was warming, that virtually anyone who follows environmental sciences can tell you about Jim Hansen. He was born in Iowa, and was, by his own account, a relatively average student through high school. At the University of Iowa, Hansen was inspired by the work of James Van Allen, the astronomer who discovered the radiation belt surrounding the Earth, and decided to study astronomy. It was actually Van Allen's interest in students that piqued Hansen's curiosity. After a student seminar Hansen delivered, Van Allen came up to talk to him. That someone so famous was that approachable was something that hadn't occurred to Hansen. "I was too shy to talk to him, and here he came up and started talking to me about what research I could do," he said. Van Allen had managed to gain the interest of other graduate and undergraduate students by allowing them to participate actively in the research he was doing. The impressions made by Van Allen on how to involve students in the learning process were very deep and have followed Hansen throughout his career.

But what made Jim Hansen switch from looking out to looking in? One simple request, as it turned out. A postdoctoral researcher from Harvard University asked Hansen for help in his project on the effects of industrial gases on the Earth's atmosphere, specifically carbon dioxide. By a strange coincidence, Hansen's PhD. concerned the climate of Venus, also rich in carbon dioxide. The two published a paper in 1975 that linked increases in other atmospheric gases to the greenhouse effect, and the rest, as they say, is history. Actually, Hansen's thesis on Venus did not focus on the greenhouse; that idea had already been studied and published by astronomer Carl Sagan. Hansen worked out an alternative proposition—that Venus was warmed by a dusty atmosphere that trapped interplanetary heat. The Soviet Venera spacecraft in the 1970's found that Venus had a thick carbon dioxide atmosphere, and that it was the greenhouse effect keeping Venus hot.

Over the years, Hansen's work has gotten him some questionable press. His theories and speeches have tended to be somewhat difficult for the layperson to grasp at first; the press has been known to take liberties with explanations of his work—in some cases, to the point where it's just plain wrong! One-sentence clips of his statements made to the Senate, when juxtaposed with photos of drought in the Midwest, gave the mistaken impression that Hansen had claimed that the greenhouse effect caused the drought. This item even ended up as a "fact" on "Jeopardy!" But the scientific community also has its objections to Hansen's work. To all this he responds, "Whenever I get bogged down, I ask what would Benjamin Franklin think if he had the opportunities that we have to analyze climate." Franklin loved to speculate about climate. He wondered whether an unusually cold winter was caused by a "dry fog" that he had noticed throughout the previous summer (apparently due to an Icelandic volcano). Franklin noted that, because of the dry fog, his "burning glass" would "scare kindle brown paper." But, Hansen says, that's all he could do—deduce and speculate. There was no way to actually prove globally what he thought was happening. "Now we can have a satellite that measures over the whole world the aerosols from volcanoes. I just try to focus on the wonderful opportunities we now have to prove our theories rather than get bogged down in reaction to the conclusions."

But there is another side to Jim Hansen that many outside GISS and New York City do not see. With his education director, Carolyn Harris, GISS's contributions to the education of students in New York City is al-



Model calculations were made shortly after Mt. Pinatubo eruption by Hansen et al. Stratospheric and tropospheric observations, obtained by satellite, are from M. Gelman of NOAA and J. Christy of Univ. Alabama, respectively. Surface temperatures are from land-based (continental and island) meteorological station records of Monthly Climatic Data of the World.

most the stuff of legend. Making the science "exciting and realistic" gets children hooked for life. Hansen's favorite outreach project, having students help study the effects of Mt. Pinatubo on the atmosphere, does exactly that. Three years ago, there were four high schools and about three colleges in the City Universities of New York system involved in doing research on Mt. Pinatubo. "Now there are about seven projects, with 54 students and teachers participating this summer," he says. "That may sound like a lot, but there are over one million students in New York City," he continued, "and we can't get to them all directly. We just don't have enough people." Hansen's philosophy on outreach is simple—if education and outreach have to be done after all the regular work is finished, it becomes hard to do a good job. If it's built in to the day, though, it's a little easier. Hansen himself would like to be able to spend more time with the teachers. He also wants to develop education modules in areas of science such as climate change, which could help explain the problem while making the learning fun. That is what he'd like to see more of—opportunities for students to actively participate in research and have fun in the process.

Working with the students is very rewarding as well. At the end of the summer, each student has to present his or her research project in front of an audience that normally includes VIP's such as NASA Administrator Dan Goldin. "The first year," he recalls, "we were coaching the kids all through the days before the presentation. They did fine. This year, Joe Rothenberg was there, and they did all the work themselves. It was great." This year, Hansen took his team to Princeton University's Geophysical Fluid Dynamics Laboratory, where he was to give a seminar. The kids actually ended up giving the talk. "No one walked out, either. It must have been an extraordinary thing for the [Geophysical Fluid Dynamics] Laboratory, but the audience seemed impressed and gave them an ovation."

It is clear that Hansen really loves to work with students, but his research is also important. So important, in fact, that the National Academy of Science elected him a member earlier this year. "I was very surprised," he said. "I didn't know I was being considered. Sherry [Dr. Sherwood Rowland] called to tell me I'd been accepted and I didn't know what to say." Because membership in the Academy is by peer review of a scientist's research and achievements, Hansen considers this quite an honor. He's not sure yet whether this means he'll have any special duties, though, other than attending Academy meetings.

And that's fine, because he has plans for more satellite projects with the students of New York City. While it's too early in the program to tell whether his projects are having any real effect on the kids, he does know that several of the students have gone on to college to major in science. The children he works with are all at risk, so it's especially rewarding to be able to turn them on to learning and knowledge.

What will he do next? "I want to work on a better 'Wonderland' model—it's something that lets us simulate climate change very quickly," he notes. Otherwise, he plans to continue his work with his kids, finding out the long- term effects of Mt. Pinatubo and how the volcano actually fits into the larger scheme of things with respect to global atmosphere. He also plans to continue his favorite research, trying to get a real handle on aerosol and cloud forcing on the atmosphere. "The reward in science," he maintains, "is the opportunity to understand the processes. It's a fantastic feeling to watch how the world responds to climate forcing."

— Kathy Pedelty

Greetings of the Season and Best Wishes for the New Year

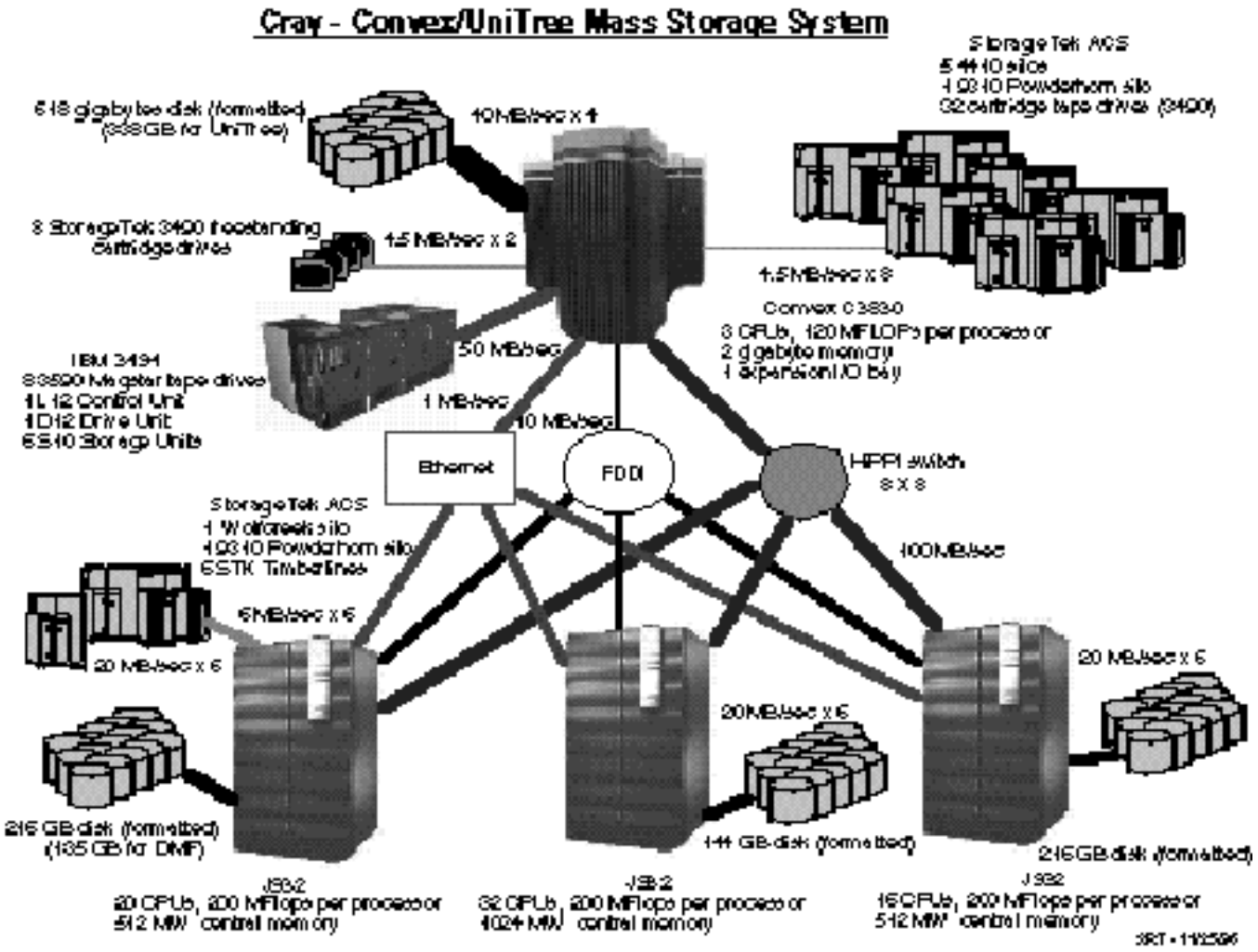
Finding a Data Needle in an Archival Haystack

Imagine, if you will, that you have a pretty good–sized room—on the order of several thousand cubic feet—filled—to the brim, in all three dimensions—with tapes filled to full capacity with digital data. To make it even more interesting, let's say you have, oh, 30 terabytes (TB)—that's 30,000,000,000,000 bytes; some 20 or so Library of Congress equivalents—of data on those tapes. And imagine, if you will, that you have to find, say, 10 megabytes (MB) of information somewhere in that mass of data. Not just any 10 MB, but the 10 MB you gleaned from a satellite transmission some 3 years ago, in a file that you named TOMS_Ozone _11–19–93. Just to keep it interesting imagine, if you will, that you must find those data in about 10 seconds, and begin transferring them to your workstation so you can get your research done.

Now, isn't that a fun–filled image?

Well, that's the kind of task that the folks in the Science Computing Branch (Code 931) in the NASA Center for Computational Sciences (NCCS), under the direction of Ms. Nancy Palm, have undertaken to fulfill. To be sure, they've made it a bit easier on themselves: The "room" isn't packed—they've left themselves some room to maneuver—but the rest of the scenario is valid.

Utilizing state–of–the–art robotic mass storage technologies, the team in Code 931 has implemented a mass storage system that allows registered users to store and retrieve their own data at will. Users can store data un-



der any name they choose, in any format they choose. They can use families of files that may be retrieved by themselves or anyone else to whom they give access, all under direct user control, without the intervention of additional computer operators. Can you think of any government that puts this much direct control in the hands of its electorate?

The NCCS, part of NASA/Goddard's Earth and Space Data Computing Division (ESDCD), Code 930, has as it mission to enable advanced scientific research and modeling for NASA–sponsored space and Earth science researchers by providing a high performance scientific computing, mass storage, and data analysis environment.

Science efforts supported by NCCS resources include continuous satellite weather data assimilation; atmos–pheric, terrestrial, and oceanographic modeling; atmospheric chemistry; solar–terrestrial interactions; precision orbit determination; algorithmically derived satellite products, such as precipitation, clouds, temperature profiles, etc.; magnetohydrodynamics; and astrophysics. By allowing very fast access to extremely large data sets, the mass storage facility now allows users to perform computational feats that would otherwise have been data–limited, and supports GSFC's supercomputing capabilities at extremely efficient levels.

According to Dr. Milt Halem, Chief of the ESDCD, "This mass storage facility is the most active open mass storage data mover in the world."

System Requirements

GSFC's computing requirements are different from most supercomputer centers in the world because the computation generated here often must be reanalyzed for statistical validity. For example, in climate prediction one run is not sufficient to draw conclusions. What is needed are ensembles to address the natural variability of seasonal and inter-annual simulations; that is, essentially, averaging to get good statistics. Thus, all such long simulations must be saved, to be recalled and averaged to estimate the model's natural variability. Similarly, data assimilation requires all observational data taken every 6 hours as input to 6–12h forecasts, and simulations must be continually updated with real satellite data at more frequent times of observation. All this computation requires fast and easy access to many gigabytes of data at a time.

To meet the scientific requirements of GSFC's researchers, a data storage and retrieval facility has been installed that significantly reduces the requirement for support staff while simultaneously providing system users with the utmost in utility.

The System

The system is based on a Convex 3830 server, which is connected to a bank of Convex IDC disks, providing 338 gigabytes (GB) of on–line storage. The system is connected to three Cray J932 supercomputers, and is directly accessible by workstations and other platforms.

Because the system already has to handle some 30 TB of existing data, on–line storage is inadequate, and installing enough hard disk space to handle all those data would be prohibitively expensive. To meet the need for low–cost, time–effective storage, tape–based data storage is clearly a more cost–effective medium despite the slower access time than is provided by disks.

To save time—and space on the tape—as data are deleted (under user control), data are continually being repacked on the cartridges so there are no gaps. Similar repacking is done as data are migrated from storage on disks to near–line storage in the silos (where they may be used in the near–term), to off–line storage when data are not going to be used in the near term. This repacking and migration takes place during slack times during the day and primarily at night, so as not to have a negative impact on productive use of the system.

As with all computer systems, they are nothing more than giant door stops unless they have instructions to tell them what to do. In this case, the Convex server runs ConvexOS, an industry–standard, open operating system, supplemented with the Convex UniTree file handling system, the software that manages the mass storage system.

UniTree allows data on cartridges to appear, for all intents and purposes, as if they were resident on disk. The only difference is that if the files need to be retrieved from tape, then one has to add in the extra time to mount the tape and copy that file from tape to disk. This results in a "virtual disk system," and users do not have to concern themselves with where the data are located. They just call for a file transfer, and the system takes care of finding the file, spooling it to disk, and transferring it to the requesting workstation.

Accessing The Data

Access to the system from within GSFC is via any of several routes, but all using existing high–capacity networks. Users obtain access to their files through a standard ftp–based session to the server. From the time a request for a given file is made until that file begins to be spooled to one of the Convex system's disks is on the order of 10 seconds. In real–world terms, it takes—on average—as few as 2 minutes for that file to be accessible to the workstation of individual requesting it. Unfortunately,

users are still experiencing lags as long as 20 minutes before data become available, for a variety of operational reasons.

"I think we can do better than 20 minutes to mount a tape when there are tape drives available," says Ellen Salmon (Code 931), "especially when I know there are other sites with the MVS [IBM mainframe operating system software] that are doing it at 500–600 tape mounts per hour."

Representatives of Code 931 are working with all vendors to address this problem.

Current traffic on the system consistently supports data transfers on the order of 150 GB per day, requiring 1,500 to 3,000 tape mounts daily. All but a very small percentage of these mounts are accomplished entirely automatically, thereby dramatically reducing the need for support staff.

Users outside of the GSFC system can, after having been given the necessary file access rights, retrieve specified data across the Internet by use of anonymous ftp. For the first time in the history of the NCCS, access to the system is available not only to authorized users, but to anyone in the world with access to the Web.

"The group that makes the most use of UniTree anonymous ftp to make data publicly available are the TOPEX people from the Space Geodesy Branch (Code 926)," says Salmon. "So far they have stored nearly 1,000 files there, and their data have been accessed nearly 600 times from sites like JPL, France, Spain, and the USAF's Phillips Laboratory."

Eventually, indexes of some data holdings will be formatted using Hypertext Mark–up Language (HTML), thereby helping to make the data made available across the Internet directly.

System Integrity

To date, there have been no catastrophic failures, although a few glitches were found in testing to support a move to the current version of the UniTree software. Most recently, rain leaked into one of the least–often–used silos; fortunately, the data on the affected tapes were recovered.

Of obvious concern to users is the cost associated with using such a complex system. Halem is very pleased to note that while storage is not provided for free, users are charged only for the cost of the tape cartridge itself, about $10.00 a gigabyte per year. Given that tape capacities have grown from earlier 200 MB capacities to the currently available gigabyte range, this charge has become extremely cost effective. However, some users at Goddard have so much data stored on the system that they won't release that their annual fees can reach in excess of $25,000!

"In the very near future, we'll be using 10 GB tapes with our latest IBM storage device, the Magstar, which should reduce users' storage costs by a factor of ten," Halem says. "What technology is helping us do is maintain user archives at a cost burden that is easy for the scientists to accommodate. It looks like we'll continue this trend again next year when we go to 50 GB cartridges."

Using The System

Users are quite happy with the system. Bill Ridgway, of the Climate and Radiation Branch (Code 913), says, "I used UniTree as a production system for archiving GOES satellite data over a period of about 6 weeks in late 1995. I created an automated scheduler on a local workstation to transfer 'global snapshot' files (375MB each, 3GB per day) to UniTree every 3 hours. The work supported field experiments in Brazil, which were measuring smoke aerosols resulting from rain forest burning. We wanted to record simultaneous GOES

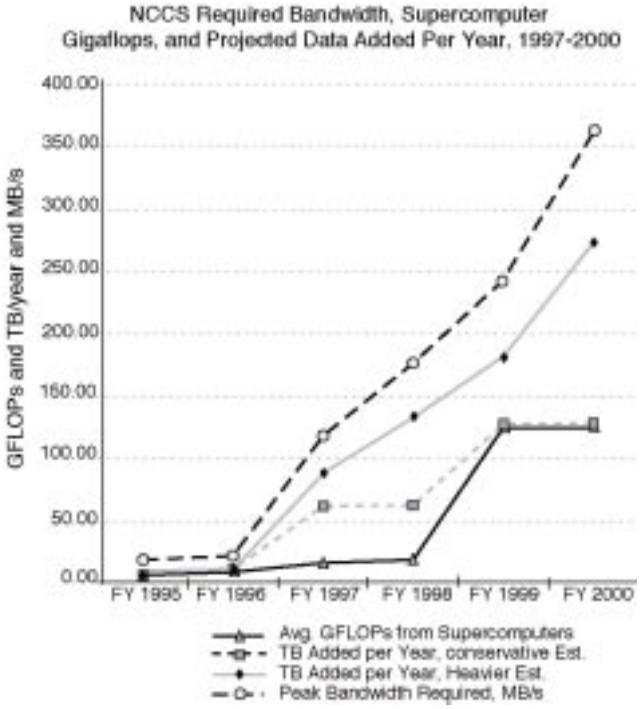


Figure 2. Storage and Network Bandwidth Requirements Through the Year 2000 for the NASA Center for Computational Sciences.

satellite images at visible and infrared wavelengths. Generally, UniTree worked well as a production system. There was no need for monitoring or intervention on a daily basis."

Dr. Halem and Ms. Salmon both mentioned one of their favorite success stories, which came from Dr. Paul Schopf (Code 971) and Dr. Max Suarez (Code 913), who initially preferred to use a system that they had assembled in their own facility.

As Schopf relates, "We in the Coupled Climate Dynamics Group have been routinely using our own Exabyte Robotic Tape storage units for saving our model history outputs. As calculations run on the NCCS systems, they send the output data back to our workstations, where we have 50 GB of staging disk and storage for about a terabyte of data on Exabyte cartridges. This system has worked well for us in being a low–cost, reliable means of saving our data that is integrated into our own system backup facilities. The drawback of the system is that user intervention is required to load, maintain, and otherwise tend the tape storage units. We recently found that improved access time through FDDI and improvements in the mass storage provided by NCCS have meant that it is considerably easier to store our data on the NCCS system. Hardware and software maintenance on our tape units is greatly reduced, the programmers can submit jobs without having to worry about conflicts over tape drive access, and the data cataloging system is through the familiar Unix file system...In the final analysis, I feel that the easier access to data makes it more effective in the long run to utilize the mass storage system provided by the NCCS."

Halem rephrases the Schopf–Suarez experience in terms of their having been inundated with the overhead involved in having to manage their own data, forcing them to divert much of their valuable time that would otherwise have been devoted to science into labeling, filing, record–keeping, and storing the data that had overflowed their office library shelves.

The Future

Such statements are indicative of why system growth has been so rapid. As seen in figure 2, use of the system and total data holdings are expected to increase rapidly into the next century.

System growth is expected to reach storage capacities of about 100 TB by the end of FY97. Ultimately, the system has been sized to allow greater than 200 TB capacities. Although the basic specifications were laid out about 6 years ago, much of the design of the system is responsive to a 1995 report from the Computing Environments and Research Requirements Committee (CERRC), entitled *NASA Earth and Space Science Computing Requirements for 1997–2004*. In that report, the committee noted that, "High performance communication between the supercomputer platform(s) and the data server platforms is...essential so that inadequate data delivery does not cause idle time on the supercomputer."

"The fundamental change that's taking place in computing and scientific research models is that we're going from a need to have increased cycles, FLOP's, etc., to a need to be able to find and retrieve bytes. We've gone from computer–intensive to data– intensive," says Halem. "The goal of a teraflop computer must be accompanied by implementation of a petabyte–capacity storage system."

With the implementation of the mass storage systems described here, the Science Computing Branch of the ESDCD is at the leading edge of this revolution, and well placed to support the scientific and engineering research needs of GSFC.

— Dr. Mitchell K. Hobish

Earth Sciences News

The Newsletter of the Earth Sciences Directorate

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SPOTLIGHT on Education

Ambassadors of Good Science

The Maryland Earth and Environmental Science Teacher Ambassador Program (or Ambassador Program for short) matches teachers from 24 school districts in Maryland with volunteer science mentors at Goddard. For an entire summer, the teachers are immersed in Earth system science, learning the techniques and tools to shape a new generation of scientists while interacting with their mentors. This is the third year of the program, with 45 teachers having participated so far. This year, 22 teachers were here for the summer. From September on, the teachers are expected to check in with their mentors regularly to keep their information up to date. The teachers are even provided with technology tools with which to do their work. Each teacher is given a Power Macintosh computer, a laser printer, a modem, various software programs and disks, a weather station, and an Internet account. They are taught how to use the computers and how to use and access such networks as the Internet and Spacelink (a NASA education network). With these tools, each teacher is expected to do an implementation plan along with monthly progress reports.

The program is designed to support the Maryland Goals and Standards for Earth and Environmental Science, which are aligned with national goals. In addition, each participant is given 6 graduate credits in Geology from the University of Maryland.

Partnering with a Maryland Teacher Ambassador allows me to share ongoing projects in the Laboratory for Terrestrial Physics with middle school students at Mount View Middle School in Howard County. I'm an advisor to Tom Albert, a sixth grade earth science teacher. I have also become a resource to his students as they work on projects in earth science and astronomy.

Tom highlighted his involvement in the Ambassador program in a presentation to parents on "back to school" night in early October. At that time, he told parents that their children would be talking with a Goddard scientist via E-mail, and that she would also make classroom visits. He reported to me that both parents and students are very excited about the involvement with Goddard. Since then, several of Tom's students have contacted me. One wanted to know about bacteria in space. Another is interested in water on other planets.

Tom and I are working on a project that would highlight the upcoming missions to Mars by using the excitement surrounding the possibility of ancient life on the planet. We plan to have students predict where fossil evidence for life on Mars would be found by first examining the geologic record of life on Earth. I will spend a day at the school sharing Viking data with the students and teaching them some basic planetary mapping techniques. Tom's classroom is also a networked computer lab, so his students have access to low- and high- resolution Viking images via the Internet. At the conclusion of their investigation, students will recommend possible sites on Mars for further exploration. Within this context, the students will learn about the instruments on the Mars Global Surveyor and how MOLA (Mars Orbiter Laser Altimeter) topographic data can increase our understanding of the geologic processes on Mars. Working with Tom and the other ambassadors, I hope to involve Maryland middle school and high school students as we receive MOLA data in 1997.

—Stephanie Stockman, Guest Writer

(Continued from Message from the Director of Earth Sciences)

gic Plan) http://www.hq.nasa.gov/office/mtpe; (Goddard Strategic Plan Home Page) http://neptune.gsfc.nasa.gov/strategic_plan. It is increasingly important that we place due attention and achieve the right balance to performing enabling functions that provide the entire Earth science community access to NASA and Goddard resources, maintaining the highest possible standards, accomplishments, and leadership in scientific research, and performing outreach to the public at-large in a variety of ways such as those described in this newsletter edition. I will be working with the Directorate senior staff and striving in other ways to communicate with each of you about these changes and what they mean. There have been a several positive effects that have occurred due to the planning and associated changes over the past few many months. An illustrative example is the identification of the Center as one of the groups selected for a site visit President's Quality Award (PQA-similar to the Baldridge Award). The Center submission described many of the accomplishments at the Center and described where the Center is planning to go in the future. A PQA team will be visiting the Center in January to gather more detail and it is important that all of us are conversant with those accomplishments and ideas for the future (as indicated in the documents noted above) so as to give this team substantive indications of what a great place Goddard is and will continue to be in the future.

Finally, I wish to take this opportunity to thank everyone in the Directorate for the many exemplary accomplishments that I see happening nearly every day. These are strenuous times, but I am sure that if we continue to do our best and strive to excel in every way possible, the right things can and will occur and allow the exciting environment in which we work and the invigorating atmosphere at Goddard to be continue and be enhanced. It is my hope that this holiday season and the upcoming 1997 year will be a great one for each and every one of you.

EDUCATION AND OUTREACH

GLOBE School Visit: Fritz Hasler (Code 910) was a guest of Dr. Eliichiro "Atom" Harako, a professor at the Gakugei University, at the Attached Oizumi junior high school for returnees (many students have formerly lived abroad) which is associated with Gakugei University. He visited the class of Dr. Junji Horiuchi, who had acquired a computer setup and access to GLOBE. The students demonstrated how they used GLOBE Web pages to enter data, and Dr. Hasler demonstrated some of the Globe visualization pages.

The Global Change Data Center (GCDC) hosted tours as part of the Technology Transfer and Commercialization Office's Business After-hours Networking Event, July 18, 1996. The Goddard DAAC and GCMD were highlighted as means for industry to learn more about available Earth Science data. The importance of outreach and making the data readily available and usable was emphasized for building a customer base.

An "Image Processing for Educators Workshop" was presented by Penny Masuoka and Larry Jessie (Code 920) on August 20 to members of the science department teaching staff of Prince George's Community College. The workshop was held at Goddard's Teacher's Resource Center. Participants included both the Science Division and Department Chairs along with teachers of Physical and Biological sciences. PGCC science teachers are interested in applying digital image processing in the classroom, and this workshop gave them hands-on experience using two powerful software packages.

Jeanne Sauber (Code 920) and Stephanie Stockman (Code 920/SSAI) have developed a close working relationship with the Kodiak, Alaska, High School science teachers and their students, some of whom participated in a GPS measurement program organized by Jeanne to study the subduction process in Alaska. Several presentations at GSA and elsewhere have resulted, and a paper entitled "Kodiak Island Subduction Zone: A High School and NASA Join Forces" was submitted to the *Journal of Geoscience Education*, which describes the continuing interaction between GSFC and the High School and local community. Now that collaboration seems to be snowballing, with a second (Glenallen) and possibly third (Cordova) high school joining the effort. The attraction is in part that the science Jeanne is doing is "locally relevant" as all these communities live with the threat of a major earthquake sometime in their future.

Several members of the Goddard DAAC attended the Earth System Science Educators workshop. The workshop focused on developing undergraduate educational materials (lectures, laboratory and independent study) in 15 areas of Earth system science. The Goddard DAAC members attended to help link the data available from the Goddard DAAC and the Mission to Planet Earth with the materials that these faculty members will be producing over the next 2 to 3 years.

Recently, a joint project between Geary Schwemmer (Code 912) and Western Maryland College was the subject of an article in the Carroll County *Times*. The following is a summary of the activity:

A Holographic Scanning Telescope was developed and patented by NASA with university and industry participation. This technology will provide an alternative to conventional large–aperture scanning receivers for lidars to measure various atmospheric properties. Many of the measurements are requirements for future NASA and NOAA spaceborne platforms. The working prototype featured in the newspaper article was built and tested at NASA/GSFC with DDF funding. In November 1995, Goddard entered into a Memorandum of Agreement with Western Maryland College, where Dr. David Guerra will use and operate the system at the Westminster campus to do research on tropospheric pollution and weather, as well as to evaluate the technology and to train undergraduates in its function and applications.

Paul Lowman (Code 921) has been doing yoeman's work for Educational Programs and Public Affairs. He has given talks to the Maryland Teachers Ambassadors Program, the NEWMAST Program, the 1996 Space Academy Class, and the GSFC Retirees and Alumni Association. He also participated in a critique of an Oxon Hill high school student design for a lunar base, which was an entry in a national competition held at Kennedy Space Flight Center in July.

Two Best Web Sites

Two World Wide Web pages that Norman Kuring (Code 902) and Gene Feldman (Code 902) support have been recognized as being some of the best educational Web sites for this year by I-Way Magazine. The URL is http://www.cciweb.com/iway500/fall96/educat.html. I-Way Magazine excerpts are:

The Jason Project Lets students control and gather data from a deep-sea submersible that explores the seafloor through satellite downlinks to schools. The Jason Foundation for Education is dedicated to delivering original interactive curricula and programs developed for grades 4 through 8. You'll find a teacher's guide and a searchable database containing project information. In the Students' Corner section, kids can participate in discussion groups, take a tour of the NR-1 submarine, meet the Jason VII scientists, and view some of the artwork other students have sent in. Students and teachers learn the principles of scientific investigation through hands-on classroom activities as well as online collaboration over the Internet.

The Smithsonian's Ocean Planet Homepage is a vast resource for information on the world's oceans. It uses cutting-edge technology to deliver text, images, and walkthrough graphics to promote conservation of the world's oceans.

Code 900 Scientists Contribute to the Education of Future Science Teachers

This summer, Code 900 scientists served as mentors to six Maryland college students who are training to be math and science teachers. The students are part of the Maryland Collaborative for Teacher Preparation (MCTP). MCTP is an NSF funded mathematics and science teacher preparation program. The project involves public colleges and universities throughout the State of Maryland. The goal of the MCTP is to produce a new type of teacher for the upper elementary and middle school grades who will be confident in mathematics, science content, and methodology, and will provide a challenging and exciting learning environment for all students.

During the planning process for MCTP, scientists involved in the project offered to provide research experiences for MCTP students in their science and mathematics fields. In addition to the research experiences, MCTP students also have the opportunity to participate in internships at informal science and mathematics sites such as museums, nature centers, zoos, and parks.

Three MCTP students interned in Code 920, two were at Wallops Flight Facility in Code 972, and one worked in the Goddard DAAC. The interns were involved in ongoing research projects as well as the development of educational materials to support Code 900's outreach efforts. Stephanie Cheung (UMCP) worked with Elissa Levine (Code 923) developing and testing a soil erosion activity for the GLOBE program. In the Geodynamics Branch, Jessica Thomas (UMCP) interned with Herb Frey compiling evidence for multiring impact basins in the Daedalia region of Mars. Josephine To (UMCP) worked in Code 920.2 with Penny Masuoka developing an interactive multimedia educational CD–ROM on remote sensing. Josephine selected the information for inclusion on the CD and wrote the accompanying text. DAAC intern Michelle Willemain (Town State) created a fossil collecting guide for Maryland that will be accessible on the Internet. Carla Evans was Michelle's mentor. The two interns at Wallops Flight Facility worked in the Rain–Sea Interaction Facility on Larry Bliven's project studying the effects of rainfall on air–water gas exchange. Michelle Lee (UMBC) and Becky Wukitch (UMCP) were also mentored by Larry Rossi. In addition to their gas exchange research, they also developed Web pages highlighting their project.

— Stephanie Stockman, Guest Writer

Honors and Awards

Congratulations to **Jim Hansen** on being the newest recipient of the Nordberg Award. The Nordberg Award was given to him for his pioneering efforts in warning the community of the possibility of global warming resulting from the injection of anthropogenic trace gases, such as CFC's and methane in the high atmosphere.

The Association for Federal Information Resource Management (AFFIRM) has awarded the AFFIRM Leadership Award to **Paul Chan** (Code 902) for his leveraging of information technology for mission accomplishment and customer benefits.

The Goddard GLOBE visualization group received a Federal Showcase Award at the Federal Webmasters Workshop '96. The awards are given for cutting edge technical implementations in the use of the Web/Internet in agency business.

Dennis Chesters (Code 913) received a special award from the American Meteorological Society for his work on GOES.

Mark Schoeberl (Code 910) has been selected to be a Fellow of the American Association for the Advancement of Science.

Inez Fung (Code 940) has been selected to be a Fellow of the American Geophysical Union.

Fritz Hasler (Code 910) and **Ed Masuoka** (Code 920) received special recognition at the Government Computer News Forum in June at the National Space Club.

John Ward (Code 972) and **William S. Ward** (formerly Code 972) received the Space Act Patent Application Award for a "Low Cost GPS Generator."

A NASA Acquisition Improvement Award was given to the **Atmospheric Pollution, Aerosol, Chemistry Satellite Acquisition (APACS) RFP and SEB team**.

Eric Liu, son of Tony Liu, Code 971, was presented a NASA Scholarship by Joe Rothenberg. He will be attending MIT.

1996 Centerwide Group Awards that included Code 900 employees: Chemistry Study and Implementation Team, Galileo Probe Mass Spectrometer Experiment Team, Mars Orbiter Laser Altimeter Development Team (MOLA-a), Scientific & Administrative Mainframe Consolidation Team, Tenacious TOMS-EP/Pegasus(R) Teams.

The paper "Understanding Biosphere-Precipitation Relationship: Theory, Model Simulations and Logical Inferences" by **Yogesh Sud** (Code 913) **William Lau** (Code 913), **Gregg Walker** (GSC/913) and **Jae–Hong Kim** (ARC/913) has been selected as the best paper published in *MAUSAM* (Arabic word for monsoon weather and climate) and awarded the 18th "Biennial MAUSAM Award."

Did you know?

Jim Garvin (Code 920) has been invited to serve on a National Academy of Sciences panel chartered with the challenge of exploring trends for reducing the space science mission costs. Dr. Garvin will be one of two NASA representatives on a panel of about 40 individuals from industry, universities, Government research laboratories, and defense.

Brian Montgomery (HSTX, Code 920) has received a letter of invitation from researchers at the World Health Organization to participate in the creation of an early warning system for influenza strains. A model of the spread of influenza exists for France, and the collaborative effort will focus on developing a global model.

Richard Stolarski (Code 916) will be on a Research & Study Fellowship at Harvard, NOAA/ERL, and NOAA/Princeton from February 1997 through February 1998.

Norden Huang (Code 971) will be on a Research & Study Fellowship at CalTech. beginning January 1997.

Steven Cohen (Code 920) received an invitation from the Institute of Geological and Nuclear Sciences (IGNS) in New Zealand to visit its institute for 3 months beginning in mid-October. The purpose of the visit is to begin collaborative studies of crustal deformation and earthquake hazards.

Chris Justice (Code 923 visiting scientist) has accepted a joint appointment with the University of Maryland, Geography Department, and the University of Virginia, Department of Environmental Sciences. Chris will continue to divide his time between Goddard and the universities.

Qinglai Dang (a postdoc working in Code 920) has been chosen for a permanent position as a professor in the forestry department of Lakehead University in Thunderbay, Ontario.

Jim Abshire (Code 924) received a patent award on October 15, 1996, for his GSFC Invention Disclosure "Picosecond Resolution Sampling Time Interval Unit."

(Continued on Page 16)

A Fond Farewell to—

Sheila Fennington/903
Dele Young/903
Robert Fraser/910
Piers Sellers/920
Nick Short/930
Amy Darden/930
David Pape/930

Welcome New Employees—

Aaron Brown/902
Richard Slywzak/902
Darnell Tabb/902
Connie Kroneman/902
Darlene Capone/903
Julie Catloth/910
Juan Rivera/910
Jeff Privette/920
David Pierce/920
David Skillman/920
Jerome Miller/930
Reginald Eason/930
Robert Caffrey/970

Get Well Wishes:

Our prayers and get well wishes to Cheryl Madison (HSTX).

Congratulations To:

Jan Kalshoven (Code 925) on his marriage to Laura Wastalu on May 26, 1996, in Joliet, Illinois.

Mark Baith (Code 970/RDC) and Karen Settle (Code 970/GSC) on their marriage in August 1996, at Virginia Beach.

Valerie McElroy (Code 923/SSAI) and Kelly Corey, who were married June 22, 1996.

Laura Blasingame (Code 923/SSAI) and Mark East, who were married September 28, 1996.

Bradford L. Fisher (Code 910.1/ARC) and his wife on their marriage in May 1996.

Johathan Rall (Code 924) and Allison Lung (UMD) on the birth of their son, Nicholas Reiley Holt on May 11, 1996

John (924) and Sally Cavanaugh on the birth of their daughter, Shaelyn Marie, on June 1, 1996

Marcos Sirota (UMBC/924) and his wife Olga on the birth of their daughter, Ariela Julia, on June 1, 1996.

Tracy Baker and her husband, Bobby, on the birth of twin girls (Sara Mae and Keri Leigh) on October 13, 1996.

Condolences to:

Bill Barnes (Code 970) and his wife Gail on the loss of her mother in July.

Bob Atlas (Code 910.3) and his family on the loss of his mother in September.

Joanna Joiner (Code 910.3) and her family on the loss of her father in September.

(Continued from Did you know?)

Jeanne Sauber (Code 921) received a request from the editors of *Physics News 1996* to use her article appearing in the *Earth in Space* magazine on deformation and glaciers in Alaska. Her article was recommended the AGU as one of four geophysical topics to be covered in *Physics News 1996.*

Jeff Pfaendtner, son of former Goddard employee James Pfaendtner (deceased, Code 910.3), won an Olympic Bronze medal for rowing on a 4-man team in the 1996 summer Olympics.

Fritz Hasler, a meteorologist in Code 912 is an outstanding trick water skier. He won the Maryland water-skiing championship held on the South River in September.

Tom Riley (Code 916) recently completed a series of self-improvement courses that he found most helpful. They are designed to improve skills in leadership and communication. If anyone would like more information regarding these courses, Tom can be reached on 6-6744 or jriley@charm.net.

Brian Montgomery (HSTX, Code 920) has been offered the position of adjunct professor at the Uniformed Services University of the Health Sciences (USUHS). USUHS is a Department of Defense medical school located in Bethesda, MD.

Goddard Selected To Receive a Presidential Quality Award Site Visit

The environment in which Goddard works has changed drastically over the last few years. This is perhaps best demonstrated by the budget and manpower/hiring constraints that are affecting us all and the way we are now pursuing new work. To meet today's challenges and ensure the Goddard continues as a premier science and technology organization, Joe Rothenberg had laid the foundation for change and is building upon it through such initiatives as the development of a new strategic plan, training for the Center's senior management in process reengineering, redesign of several key Center processes, and of course, the overall reorganization of the Center to more effectively meet our customers' needs. In the last year, Mr. Rothenberg also chartered a team to prepare an application for the President's Quality Award (PQA) Program.

The PQA Program recognizes Federal organizations that have improved their overall performance and demonstrated a sustained, positive trend in providing high–quality customer service. This program was patterned after the prestigious private–sector Malcolm Baldrige Quality Award and includes a review of an organization's leadership, management of information, strategic planning, human resource development, process management, business results, and customer satisfaction. The program's primary goal is to promote the structured evaluation and improvement of an organization's processes in all of these areas.

Goddard applied for this award for several reasons. First, it was an opportunity to document Goddard's achievements and best practices and for the Center to be recognized for its many successes. The Center's products, your products, are truly exceptional and we must do a better job of spreading the word. It was also an opportunity to evaluate the Center in the context of an accepted standard, to better understand our strengths and weaknesses, and to help us prioritize and focus our improvement efforts to get the "most bang for the buck." The President's Award Application Team worked for ten months and submitted the application in October. A team of evaluators will be making a "site visit" in mid-January to further evaluate the Center. This in itself is an achievement as no other NASA Center has been selected for a site visit in response to their initial application.

As we prepare for the upcoming site visit, we will be looking for ways to apply what we've learned, communicate in more effective ways, and lead the Center in product and process improvement. Key to our success is your proactive involvement. You will soon be receiving both copies of the PQA application and the Center's new Strategic Plan. Please take the time to read each one and focus on those areas where your contributions are of greatest importance. By involving yourself in improving the Center, you will help ensure Goddard's future as a vital and effective national resource.